Claims

[c1] A method for imaging a desired coronary artery or desired portion thereof utilizing a computed tomography (CT) imaging system comprising a rotating gantry, a detector array on the rotating gantry, and a radiation source on the rotating gantry configured to project a beam of radiation towards the detector array through a patient's heart;

said method comprising:

scanning a volume of the patient's heart with the CT imaging system to acquire projection data, the volume including at least a first desired coronary artery branch segment and a second desired coronary artery branch segment, and the acquired projection data including a first projection dataset representing the first desired coronary artery branch segment acquired during a first desired cardiac phase of a plurality of cardiac cycles of the patient and a second projection dataset representing the second desired coronary artery branch segment acquired during a second desired cardiac phase of a plurality of cardiac cycles of the patient;

selecting the first cardiac phase corresponding to a low motion period of the first desired coronary artery branch segment of a patient's heart and selecting the second cardiac phase corresponding to a low motion period of the second desired coronary artery branch segment of a patient's heart;

reconstructing a first 2D image of the first desired coronary artery branch segment utilizing the first projection dataset acquired during the first desired cardiac phase of a plurality of cardiac cycles to reduce motion artifacts of the first desired coronary artery branch segment;

reconstructing a second 2D image of the second desired coronary artery branch segment utilizing the second projection dataset acquired during the second desired cardiac phase of a plurality of cardiac cycles to reduce motion artifacts of the second desired coronary artery branch segment;

reconstructing at least one 3D image of the coronary artery utilizing the first 2D image and the second 2D image.

[c2] A method in accordance with Claim 1 wherein said reconstructing at least one 3D image including the first desired coronary artery branch segment and the

second desired coronary artery branch segment comprises reconstructing a first 2D image excluding projection data other than the first projection dataset acquired during the first selected cardiac phase of a plurality of cardiac cycles and a second 2D image excluding projection data other than the second projection dataset acquired during the second desired cardiac phase of a plurality of cardiac cycles, and combining the first 2D image and the second 2D image to effectively reduce motion artifacts of both the first desired coronary artery and the second desired coronary artery in the generated 3D image.

[c3] A method in accordance with Claim 1 wherein said reconstructing at least one 3D image including the first desired coronary artery branch segment and the second desired coronary artery branch segment comprises selectively utilizing the first projection dataset acquired during the first desired cardiac phase of a plurality of cardiac cycles and the second projection dataset acquired during the second desired cardiac phase of a plurality of cardiac cycles in reconstruction to effectively reduce motion artifacts of both the first desired coronary artery and the second desired coronary artery in the 3D image.

[c4] A computed tomography (CT) imaging system having a rotating gantry, a detector array on said rotating gantry, and a radiation source on said rotating gantry configured to project a beam of radiation towards said detector array through a patient's heart;

said system configured to:

scan a volume of a patient's heart to acquire projection data, the volume including at least a first desired coronary artery branch segment and a second desired coronary artery branch segment, said acquired projection data including a first projection dataset representing said first desired coronary artery branch segment acquired during a first desired cardiac phase of a plurality of cardiac cycles of the patient and said second projection dataset representing a second desired coronary artery branch segment acquired during the second desired cardiac phase of a plurality of cardiac cycles of the patient;

utilize a data compilation of low motion cardiac phases and corresponding coronary artery branch segments to select the first cardiac phase corresponding to the desired first coronary artery branch segment;

utilize a data compilation of low motion cardiac phases and corresponding coronary artery branch segments to select the second cardiac phase corresponding to the desired second coronary artery branch segment;

reconstruct a first 2D image of said first desired coronary artery branch segment utilizing said first projection dataset acquired during the first desired cardiac phase of a plurality of cardiac cycles to reduce motion artifacts of the first desired coronary artery branch segment;

reconstruct a second 2D image of said second desired coronary artery branch segment utilizing said second projection dataset acquired during the second desired cardiac phase of a plurality of cardiac cycles to reduce motion artifacts of the second desired coronary artery branch segment; and

reconstruct at least one 3D image of the coronary artery utilizing the first 2D image and the second 2D image.

[c5] A system in accordance with Claim 4 wherein to reconstruct a 3D image of the volume of the patient's heart, said system is configured to reconstruct said image without utilizing projection data other than said projection data acquired during said desired cardiac phase of the plurality of cardiac cycles.

[c6] A system in accordance with Claim 4 wherein said data compilation of low motion cardiac phases and corresponding coronary artery branch segments is a data compilation derived from observations of a plurality of individuals.

[c7] A system in accordance with Claim 6 wherein said data compilation is derived solely from individuals other than the patient.

[c8] A computed tomographic (CT) imaging for acquiring views of an object, said CT system comprising:

a rotating gantry;

a detector array on the rotating gantry;

at least one radiation source on the rotating gantry; and

a computer coupled to said detector array and said radiation source, said computer configured to:

scan a volume of the patient's heart to acquire projection data, the volume including at least a first desired coronary artery branch segment and a second

different desired coronary artery branch segment, the acquired projection data including a first projection dataset representing the first desired coronary artery branch segment acquired during a first desired cardiac phase of a plurality of cardiac cycles of the patient and a second projection dataset representing the second desired coronary artery branch segment acquired during a second desired cardiac phase of a plurality of cardiac cycles of the patient;

select the first cardiac phase corresponding to a low motion period of the first desired coronary artery branch segment of the patient's heart and select the second cardiac phase corresponding to a low motion period of the second desired coronary artery branch segment of the patient's heart;

reconstruct a first 2D image of the first desired coronary artery branch segment utilizing the first projection dataset acquired during the first desired cardiac phase of a plurality of cardiac cycles to reduce motion artifacts of the first desired coronary artery branch segment;

reconstruct a second 2D image of the second desired coronary artery branch segment utilizing the second projection dataset acquired during the second desired cardiac phase of a plurality of cardiac cycles to reduce motion artifacts of the second desired coronary artery branch segment; and

reconstruct at least one 3D image of the coronary artery utilizing the first 2D image and the second 2D image.

[c9] A system in accordance with Claim 8 wherein to reconstruct at least one 3D image including the first desired coronary artery branch segment and the second desired coronary artery branch segment, said computer is configured to reconstruct a first 2D image excluding projection data other than the projection data acquired during the first desired cardiac phase of a plurality of cardiac cycles and a second 2D image excluding projection data other than the projection data acquired during the second desired cardiac phase of a plurality of cardiac cycles, and combine the first 2D image and the second 2D image to effectively reduce motion artifacts of both the first desired coronary artery and the second desired coronary artery in the single 3D image.

[c10] A system in accordance with Claim 8 wherein to reconstruct at least one 3D image including the first desired coronary artery branch segment and the

second desired coronary artery branch segment, said computer is configured to selectively utilize the first projection dataset acquired during the first desired cardiac phase of a plurality of cardiac cycles and the projection data dataset acquired during the second desired cardiac phase of a plurality of cardiac cycles in reconstruction to effectively reduce motion artifacts of both the first desired coronary artery and the second desired coronary artery in the single 3D image.

[c11] A computer system configured to:
utilize a data compilation of low motion cardiac phases and corresponding coronary artery branch segments to select a first cardiac phase corresponding to a desired first coronary artery branch segment;
utilize a data compilation of low motion cardiac phases and corresponding coronary artery branch segments to select a second cardiac phase corresponding to a desired second coronary artery branch segment;
read projection data acquired by a computed tomographic (CT) imaging system during a scan of a volume of a patient's heart, the volume including at least the first desired coronary artery branch segment and the second coronary artery branch segment, the acquired projection data including the first projection dataset and the second projection dataset; and
reconstruct a first 2D image of the first desired coronary artery branch segment utilizing the first projection dataset acquired during the first desired cardiac phase of a plurality of cardiac cycles to reduce motion artifacts of the first desired coronary artery branch segment;
reconstruct a second 2D image of the second desired coronary artery branch segment utilizing the second projection dataset acquired during the second desired cardiac phase of a plurality of cardiac cycles to reduce motion artifacts of the second desired coronary artery branch segment; and
reconstruct at least one 3D image of the coronary artery utilizing the first 2D image and the second 2D image.

[c12] A computer system in accordance with Claim 11 wherein to reconstruct a 3D image of the volume of the patient's heart, said computer system is configured to reconstruct the image without utilizing projection data other than the projection data acquired during the first desired cardiac phase of the plurality of

cardiac cycles and the second desired cardiac phase.

[c13] A computer system in accordance with Claim 11 wherein said data compilation of low motion cardiac phases and corresponding coronary artery branch segments is a data compilation derived from observations of a plurality of individuals.

[c14] A computer system in accordance with Claim 13 wherein said data compilation is derived solely from individuals other than the patient.

[c15] A computer system configured to:
scan a volume of the patient's heart to acquire projection data, the volume including at least a first desired coronary artery branch segment and a second desired coronary artery branch segment, the acquired projection data including a first projection dataset representing the first desired coronary artery branch segment acquired during a first desired cardiac phase of a plurality of cardiac cycles of the patient and the second projection dataset representing the second desired coronary artery branch segment acquired during a second desired cardiac phase of a plurality of cardiac cycles of the patient;
select the first cardiac phase corresponding to a low motion period of the first desired coronary artery branch segment of the patient's heart and select the second cardiac phase corresponding to a low motion period of the second desired coronary artery branch segment of the patient's heart;
reconstruct a first 2D image of the first desired coronary artery branch segment utilizing the first projection dataset acquired during the first desired cardiac phase of a plurality of cardiac cycles to reduce motion artifacts of the first desired coronary artery branch segment;
reconstruct a second 2D image of the second desired coronary artery branch segment utilizing the second projection dataset acquired during the second desired cardiac phase of a plurality of cardiac cycles to reduce motion artifacts of the second desired coronary artery branch segment; and
reconstruct at least one 3D image of the coronary artery utilizing the first 2D image and the second 2D image.

[c16] A computer system in accordance with Claim 15 wherein to reconstruct the 3D

image including the first desired coronary artery branch segment and the second coronary artery branch segment, said computer system is configured to reconstruct a first 2D image excluding projection data other than the first projection dataset acquired during the first desired cardiac phase of a plurality of cardiac cycles and a second 2D image excluding projection data other than the second projection dataset acquired during the second desired cardiac phase of a plurality of cardiac cycles, and combine the first 2D image and the second 2D image to effectively reduce motion artifacts of both the first desired coronary artery and the second desired coronary artery in the single 3D image.

[c17] A computer system in accordance with Claim 16 wherein to reconstruct said 3D image including the first desired coronary artery branch segment and the second desired coronary artery branch segment, said computer system is configured to selectively utilize the first projection dataset acquired during the first desired cardiac phase of a plurality of cardiac cycles and the second projection dataset acquired during the second desired cardiac phase of a plurality of cardiac cycles in reconstruction to effectively reduce motion artifacts of both the first desired coronary artery and the second desired coronary artery in the single 3D image.

[c18] A machine readable medium having instructions recorded thereon configured to instruct a computer to:

scan a volume of the patient's heart to acquire projection data, the volume including at least a first desired coronary artery branch segment and a second desired coronary artery branch segment, said acquired projection data including a first projection dataset representing the first desired coronary artery branch segment acquired during the first desired cardiac phase of a plurality of cardiac cycles of the patient and said second projection dataset representing the second desired coronary artery branch segment acquired during the second desired cardiac phase of a plurality of cardiac cycles of the patient;

select a first cardiac phase corresponding to a low motion period of the first desired coronary artery branch segment of the patient's heart and a different, second cardiac phase corresponding to the second, different desired coronary artery branch segment of the patient's heart;

reconstruct a first 2D image of the first desired coronary artery branch segment utilizing the first projection dataset acquired during the first desired cardiac phase of a plurality of cardiac cycles to reduce motion artifacts of the first desired coronary artery branch segment;

reconstruct a second 2D image of the second desired coronary artery branch segment utilizing the second projection dataset acquired during the second desired cardiac phase of a plurality of cardiac cycles to reduce motion artifacts of the second desired coronary artery branch segment; and

reconstruct at least one 3D image of the coronary artery utilizing the first 2D image and the second 2D image.

[c19] A machine readable medium in accordance with Claim 18 wherein to reconstruct said at least one 3D image including the first desired coronary artery branch segment and the second desired coronary artery branch segment, said machine readable medium has recorded thereon instructions configured to instruct the computer to reconstruct a first 2D image excluding projection data other than the first projection dataset acquired during the first desired cardiac phase of a plurality of cardiac cycles and a second 2D image excluding projection data other than the second projection dataset acquired during the second desired cardiac phase of a plurality of cardiac cycles, and combine the first 2D image and the second 2D image to effectively reduce motion artifacts of both the first desired coronary artery and the second desired coronary artery in the 3D image.

[c20] A machine readable medium in accordance with Claim 18 wherein to reconstruct said at least one 3D image including the first desired coronary artery branch segment and the second desired coronary artery branch segment, said machine readable medium has recorded thereon instructions configured to instruct the computer to selectively utilize the first projection dataset acquired during the first desired cardiac phase of a plurality of cardiac cycles and the second projection dataset acquired during the second desired cardiac phase of a plurality of cardiac cycles in reconstruction to effectively reduce motion artifacts of both the first desired coronary artery and the second desired coronary artery in the 3D image.